

WHAT IS CLAIMED:

1. A method of modifying cell structure comprising:
increasing the intracellular concentration of biliverdin
5 reductase, or a fragment or variant thereof, in a mammalian cell under conditions
effective to modify the structure of the mammalian cell.
2. The method according to claim 1, wherein the modified cell
structure is enhanced cell size, actin microspike formation, polar cell morphology, or
10 a combination thereof.
3. The method according claim 1 wherein said increasing
comprises:
15 introducing biliverdin reductase into the mammalian cell.
4. The method according claim 3 wherein said introducing
comprises:
20 contacting the mammalian cell with a delivery vehicle
comprising biliverdin reductase.
5. The method according to claim 4 wherein the delivery vehicle
comprises a fusion protein comprising biliverdin reductase and a ligand domain
recognized by a receptor of the mammalian cell.
- 25 6. The method according to claim 4 wherein the delivery vehicle
comprises a liposome containing biliverdin reductase.
7. The method according to claim 4 wherein the delivery vehicle
comprises an enzymatically stable conjugate comprising a polymer and biliverdin
30 reductase conjugated to the polymer.

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8. The method according to claim 1 wherein said increasing comprises:
transforming the mammalian cell with a nucleic acid encoding biliverdin reductase under conditions effective for expression of the biliverdin reductase in the mammalian cell.

9. The method according to claim 8 wherein said transforming comprises:
transfecting the mammalian cell with an infective transformation vector comprising the nucleic acid encoding biliverdin reductase.

10. The method according to claim 9 wherein the infective transformation vector is an adenovirus vector or a retrovirus vector.

11. The method according to claim 1 wherein the mammalian cell is a stem cell, a neuronal or glial cell, a vascular smooth muscle cell, a skeletal muscle cell, an epithelial cell, or a nucleated blood cell.

12. The method according to claim 1 wherein the mammalian cell is *in vitro*.

13. The method according to claim 1 wherein the mammalian cell is *in vivo*.

14. A method of *in vivo* tissue remodeling in a mammal comprising:
delivering biliverdin reductase, or fragments or variants thereof, to one or more cells present at a site of tissue remodeling in a mammal, wherein said delivering increases the intracellular concentration of biliverdin reductase, or fragments or variants thereof, under conditions effective to modify the structure of the one or more cells at the site of tissue remodeling, thereby remodeling the tissue containing the one or more cells.

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15. The method according to claim 14, wherein the tissue is epithelial tissue, nerve tissue, muscular tissue, or connective tissue.

16. The method according to claim 14 wherein the one or more
5 cells is a stem cell, a neuronal or glial cell, a vascular smooth muscle cell, a skeletal muscle cell, an epithelial cell, a nucleated blood cell, or a combination thereof.

17. The method according claim 14 wherein said delivering
comprises:
10 introducing biliverdin reductase into the one or more cells.

18. The method according claim 17 wherein said introducing
comprises:
15 contacting each of the one or more cells with a delivery vehicle comprising biliverdin reductase.

19. The method according to claim 18 wherein the delivery vehicle
comprises a fusion protein comprising biliverdin reductase and a ligand domain
20 recognized by a receptor of the one or more cells.

20. The method according to claim 18 wherein the delivery vehicle
comprises a liposome containing biliverdin reductase.

21. The method according to claim 18 wherein the delivery vehicle
25 comprises an enzymatically stable conjugate comprising a polymer and biliverdin reductase conjugated to the polymer.

22. The method according to claim 14 wherein said delivering
comprises:
30 transforming each of the one or more cells with a nucleic acid encoding biliverdin reductase under conditions effective for expression of the biliverdin reductase in the one or more cells.

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23. The method according to claim 22 wherein said transforming comprises:

transfecting each of the one or more cells with an infective transformation vector comprising the nucleic acid encoding biliverdin reductase.

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24. The method according to claim 23 wherein the infective transformation vector is an adenovirus vector or a retrovirus vector.

25. The method of repairing a damaged organ or organ system by performing said method of *in vivo* tissue remodeling according to claim 14, where the site of tissue remodeling is within the damaged organ or organ system.

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26. The method according to claim 25, wherein the organ or organ system is skin, liver, nervous system, cardiovascular system, or urogenital tract.

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